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## ON THE LOCAL GEOLOGY OF ELORA.

Read by Mr. David Boyle,

PRINCIPAL OF THE PUBLIC SCHOOL,

At the First Regular Meeting of the  
ELORA Natural History Society,  
on the 2nd of Nov., 1874.

It would probably be impossible to find a better introduction to this paper, than a sentence or two incidentally employed by a recent writer on Natural History. He says: "There is nothing that the study of geology teaches us that is more certain or more impressive than the extreme instability of the earth's surface. Everywhere beneath our feet we find proofs that what is land has been sea, and that where oceans now spread out has once been land; and that this change from sea to land, and from land to sea, has taken place, not once or twice only, but again and again, during countless ages of past time."

The introductory use of these remarks will be sufficient to indicate that a certain amount of elementary knowledge regarding the science is supposed to be already in your possession. Should this not be the case, you can scarcely do better than read one or more of the many geological works in the village library by Lyell, Page, Ansted, Sedgwick and others.

In the study of this, as of the other natural sciences, nothing so discourages the beginner as the formidable appearance of the terms used to distinguish orders, genera, species or individuals. Frequent employment of the ugly-looking names will surmount the difficulties of pronunciation, and a slight knowledge of the classical languages will go a long way towards destroying their forbidding appearance, and even make them beautiful in our eyes. A consideration of this kind alone should prompt all who may

have an opportunity to the study of both Greek and Latin.

Now, before plunging into the special department which has been chosen as the subject of this paper, it will be well, I think, to say a word or two concerning geological "formations" and "systems." One of the first principles laid down by Dr. Smith, "the father of Modern Geology," was, that no matter how much the mineral character of rocks might differ, a *stratum* could always be identified by its fossils. According to this principle, although of late years it has been somewhat modified, one, two, or more *strata* containing fossils of a like kind are known by the name of "formation," one or more of which may compose a "system." And just here we encounter another of the difficulties to beginners. In Scotland, it may be, we read of the Laurentian cropping out in the Northern Highlands, whilst in Canada, on the shores of Lake Erie and other places, we are informed that the Devonian system exists. How can a system in Britain take its name from our St. Lawrence, or one in Ontario from the County of Devon in England? In this way. Geologists have adopted, in many instances, the practice of naming a formation from that portion of the world in which the formation is most perfectly developed, or where a certain series of strata has been first studied and recognized as peculiar.

My only apology for saying anything in reference to this point is just for the sake of making it quite clear why the rocks in our neighborhood are known as "Silurian."

Sir Roderick Murchison first studied the system of which the Elora rocks form a part, and upon the principle already alluded to, called it "Silurian," from that portion of South Wales where his

investigations were made, and which was anciently inhabited by a tribe of Britons to whom the Romans gave the name Silures.

Now, when Professor Nicholson was in our neighborhood last summer, he volunteered to our President and myself a little bit of information, which so far as known to me has not yet appeared in books. It was somewhat to this effect: Professor Sedgwick, whom he pronounced a superior authority to Sir Roderick, denied the propriety of the name "Silurian," contending that the rocks so called were only a continuation in all their main fossil characteristics, of the Cambrian, which lies immediately underneath, and that therefore they should be named not *Silurian* but *Upper Cambrian*, or at most *Cambro-Silurian*. Murchison having described and named them, naturally looked upon them with a jealous eye, and insisted on the retention of the name given by him. Both Murchison and Sedgwick are now dead, and what impartial judges will do in the matter remains to be seen.

The Silurian rocks as developed in Canada are classified into sub-formations, made for the most part, as I have already explained, many of the names too taking their rise from places in New York, where they were first described, such for instance as "Utica," "Hudson River," "Onondaga." In portions of this and adjoining counties the strata take the name of "Guelph," simply because no equivalent appears to exist in New York State, and could not, as a matter of course, have been described by the American geologists.

According to Sir William Logan, late Provincial Geologist, the Guelph formation is very nearly the highest in the Silurian system, only other two overlying it, whilst not less than ten are underneath.

At Elora, again, we are, I think, considerably higher than at Guelph itself, and since the higher we go among the leaves of the rocky volume, the more likely we are to find fossils of an advanced

type, it will be easy to see the peculiar advantages enjoyed by an enthusiastic geological student in our locality.

On the banks of the rivers, the Grand and Irvine, we have just such an exposure as a student requires; an exposure which, had Nature not performed the work, it would have taken millions of dollars to accomplish; an exposure, in fact, which if it did not exist, we should wish that it did.

One of the first questions that occur to the mind of a stranger upon gazing over our precipices is, "How was this gorge formed? By water or how?" The "or how?" in such a problem is exceedingly handy, as the querist apparently asks two questions, whereas he only asks one, the "or how?" being equivalent to "well, water is out of the question altogether. I give it up." My own opinion is that the chasms were produced (for all I know ten million years ago) by a sudden convulsion of Nature—an earthquake—that if the streams had been flowing previous to that time, the infiltration of the water through the porous rock (for all limestone formations are remarkable for their porosity) so weakened it by keeping it perpetually in a moist condition, that when the shock did occur, the weaker threadlike portions marking the streams' courses first yielded to the enormous pressure from within; or, that the separation having taken place before there were streams, the water when it began to flow naturally took the lowest level, and thus the chasms became utilized as river-beds. However it may have been with regard to the streams themselves, I have no doubt at all as to the eruptive origin of the gullies, and if we accept this theory we are then driven to the conclusion that the rent portion must have been weaker than surrounding portions, whatever the cause of that weakness may have been. The name Dolomite has been given to this class of rocks to which those of our formation belong, in honor of a French geologist.

A very slight inspection of the Silurian

formation, in almost any one of its many strata, is quite sufficient to determine its aqueous origin. Corals, shells, and crustaceous animals, the latter distantly related to recent lobsters and crabs, are found in great abundance. Concerning these crustaceans—the trilobites—it may be remarked here that plentiful as they are in the Trenton, Utica, Hudson and Medina groups, all underlying our own, they appear to die out in the Clinton and Niagara rocks upon which, particularly the latter, our formation rests. No trilobites have, to my knowledge, ever been found in this locality, that is to say in our limestone rock.\* Otherwise they have, but of that afterwards. Corals in considerable variety may be picked up almost anywhere, and singular as it may appear, even a sponge. Most of the former are of the genus *Favosites*, so called from their honey-comb appearance. Another somewhat plentiful coral takes its name from the similarity which a cross-section of it presents to a chain—*Halysites Catenulatus*. Specimens of this fossil are chiefly found near the surface; at least I have never met with any at a greater depth than four or five feet. Excellent illustrative specimens are often seen in field-stones, in which cases the interstices are eroded by the action of the weather, and the chain-like walls stand out prominently. As specimens of this and other fossils referred to may be examined on the table during recess, it will be quite unnecessary to describe them at length. The sponge alluded to (*Stromatopora concentrica*) is more commonly met with than many other local fossils. On the rocky road-bed leading to the Wilkinson bridge on both sides, very large ones may be seen, and some capital weathered specimens

\*A beautiful folded specimen, *Phacops rana*, is in the museum. It was found by Mr. R. Tribe, but is doubtlessly "drift." A fragmentary specimen of very doubtful character has recently been picked up by Mr. Clarke.

may be picked up about Aboyne. Down the Grand River also, below Tribe's, any number of them may be seen in the side of the cliff. Formerly *Stromatopora concentrica* was regarded as a coral, but from a remarkably fine one submitted to Professor Nicholson's inspection by our President, the evidence in favour of its being a sponge was considered as pretty conclusive. A new species was discovered by Mr. John Wilkie, of Guelph, two years ago, and described by Nicholson, who named it *Stromatopora Ostiolata*. In company with Mr. Wilkie I visited the quarry in which he had first met with *ostiolata*, and succeeded in procuring a fair specimen after some search. It may be seen here with the rest of the objects. Returning to Elora, somewhat deeper than the region of the Favosites, concerning which nothing more need be said at present, and measuring from the highest part of the formation, we occasionally come across a very pretty species of what is commonly known as Lamp Shell, from its resemblance to an old-fashioned oil-lamp. It has been named *Pentamerus Occidentalis*, and when found with the lines sharply defined is one of the finest fossils our rocks contain. At a depth of from forty to sixty feet, other two species are met with having the same general appearance, of course, but differing somewhat in size and proportion. One of those exists in considerable numbers in a small cavern on the left bank of the Irvine River, almost below Modeland's Foundry. In the same place may be found as well, a great many beautiful specimens, some of which are probably unnamed, including species of *Pleurotomaria*, *Murchisonia*, and *Orthoceras*. I can conceive of no more profitable and pleasing way for a boy to spend a few hours, than in such a place, where almost every few minutes the hammer exposes a gracefully formed shell, which has been entombed probably a greater number of years than Adam could have counted had he been busy counting day and night to this the second day of

November, 1874.\* In this cavern too, but found usually a little higher, the student will possibly meet with that species of *Pleurotomaria*, named by Billings *Elora*. Another shell I have mentioned as being procurable in our neighborhood is the *Orthoceras*, or straight shell. Some five hundred distinct species of *Orthoceras* have been named and described in various parts of the world, and half-a-dozen at least have been brought to light about Elora. Who shall say, that as many more or thrice as many more may not reward the diligent explorer? In life these shells must have been remarkably beautiful—of all sizes from two or three inches to six feet in length, tapering gently, and richly colored.

With the exception of *Pentamerus*, all the shells noticed so far are univalves. Of bivalves we have also quite a variety. Almost all children in the village upwards of five or six years of age, can distinguish *Megalomus Canadensis*, quite as readily as they can an Early Rose potato or a Swedish turnip. It is the commonest and most characteristic bivalve in the Guelph formation. It is found of all sizes from two to six or seven inches in length, either in casts of the fleshy parts, which are the more common, or in casts representing the form of the perfect animal. *Megalomus* would seem to have reigned a king among bivalves on the shores of the Silurian seas. The immense numbers of them to be found at present is attributable, doubtless, in some measure, to the great thickness and consequent strength of the shell—from a quarter to five-eighths of an inch. Common as they are in this formation they are highly prized for European collections, as they are utterly wanting in the

\*The rigidity of the old conceptions has been relaxed, the public mind being rendered gradually tolerant of the idea that not for six thousand, nor for sixty thousand, nor for six thousand thousand, but for eons embracing untold millions of years, the earth has been the theatre of life and death.

TYNDALL.

Silurian system of the Old World. It would be almost needless to mention where the *Megalomus* may be found in this locality, but to assist those who intend to make a beginning, the quarries at Mrs. Inglis' farm, the left bank of the river any where between the carpet factory and Aboyne, a surface exposure near the residence of Highland John, and the rocks at Tribe's, yield specimens more or less perfect.

Before closing this part of my paper, I shall mention only one bivalve more—one which has carried the name and fame of Elora across the Atlantic, and caused our beloved little town to be spoken of by the most eminent palaeontologists in England, as "a very interesting locality." This shell is only found in a very circumscribed area, and, so far as I know, not being met with anywhere else than within a short distance above the Gilkinson bridge, on the right bank of the Grand River.\* Strictly speaking the shell itself is not found at all—only an interior cast, or cast of the fleshy part, and this alone is certainly a remarkable object. No cast of the exterior has yet been discovered—leading us to conclude that the shell must be exceedingly thin and fragile. The name of this fossil is *Trimerella grandis*, and I should be glad to hear of some of you devoting your spare time and energies towards the unearthing of even better specimens than our museum now possesses.

But however much invites the geological student in the rocks of the Guelph formation, his attention need not necessarily be confined to them alone. Thanks to the cold period which succeeded the hot one of the coral ages, other materials have been supplied, and some of them from great distances.

The glaciers, whose mighty masses ploughed their way slowly but irresistibly towards the south, carried with them in their icy embrace, millions of frag-

\*Besides Elora, it has only been noticed in two or three other places in the Province.



ments of rocks belonging to the regions where from climatic changes intense frost had supplanted torrid heat. Those fragments, becoming unloosed as the masses penetrated comparatively warmer regions, dropped, eventually became water-worn, were washed into hollows, and at last elevated so as to form dry land. Deposits of this kind are known to us as gravel-beds. The heavier fragments, not so easily affected by waves or tides, imbedded themselves in the ooze, heavy and always down—these we see at, or near the surface, to-day, and call them "boulders."

It is quite possible, therefore, to learn just as much from a careful examination of a boulder or a bed of gravel, as if some friend fifty, or a hundred, or two hundred miles off had sent us the same quantity of material by express, for our own special inspection. Beautiful crinoidal or mountain limestone is often procurable on the fields in the shape of boulders. I have here upon the table a perfectly defined cast of beautiful shells picked up in a field in Pilkington by my friend Mr. Sanderson. Our collection contains a boulder which has been carried from the North-West perhaps more than five hundred miles. Close by Salem is a gravel-bed in which the boys of the village procured some very fine specimens of *Strophomena*, *Ambonychia radiata*, *Avicula demissa* and trilobites, not to be found in the solid formation nearer than Owen Sound. Only last Wednesday my own little girl, who plays at Geology on the gravel walk, picked up a handsome little specimen of a trilobite's tail, in a bit of Hudson River shale. In fact the amount of interest and information derivable from an hour spent in a gravel pit, is, to one who does so for the first time, perfectly astonishing. Several pits exist even within the limits of the corporation; try them, and at some future meeting display your collections jointly or separately, and I feel confident that those who look will be equally astonished with those who

gathered. Although hammer and chisel are not quite so indispensable in pits as among the solid rocks, you will yet find them of great value. Many slaty-looking stones will be found which split easily, and frequently they contain the greatest treasures.

I have already hinted at the coloring of the ancient shells. Now, although it is quite true that none are ever met with about Elora, and seldom any where else, to indicate the possession of peculiar beauty in this respect, a moment's consideration will show the reasonableness of the supposition that the fossil molluscs were at least as variously and as prettily tinted as the average recent shell. The total absence of color in limestone specimens, can only be accounted for from the complete mineralization which has been effected by a process which may be described at some other time.

Omitting altogether the notice of many points that have doubtlessly suggested themselves to some of you, I will close this paper by an attempt to answer the irrepressible "*What good?*"

In most cases when this expression is taken out of its interrogative form and made assertive, it simply means "You can't make anything by it." Go to Fergus, or Eden, or a hundred places in this Province besides, and they will tell you that they have lost from geological ignorance. Only some ten or twelve years ago a farmer near Bowmanville ruined himself by boring for coal. Sir Wm. Logan at the time declared how utterly unreasonable the search was, and still there are to-day thousands in Ontario who believe that coal remains to be discovered within our borders. In the Island of Timor a company was formed in 1861 for the mining of copper. I quote, "So confident were they of the existence of copper, that they thought it would be waste of time and money to explore! and accordingly sent to England for a mining engineer, with tools, machinery, laboratory, utensils, mechanics, and stores of all kinds for two



years." When the engineer, who was of course a practical geologist, arrived on the spot, the first glance assured him that not a particle of copper existed there. A few months since a poor fellow out west married a widow with a large family, because he thought she owned a little hill composed largely of gold. The mineral that deceived him has deceived many more, it was simply bi-sulphuret or iron pyrites. The early French explorers of America carried home with them bushels of worthless crystals from Quebec, supposing them to be diamonds. But is there no profit other than that of dollars and cents? Why do we enjoy a walk—a fine view—a flower garden—a beautiful picture, or an exquisitely executed piece of machinery? Just, I take it, because we meet with an appeal to the imagination either in one form or another. And I contend that no more forcible appeal can possibly be made, than the study of this science affords us upon every hand. Now and again a discovery is made of a few Indian relics, and on reading the account it is impossible to avoid contrasting the Canada of to-day with Canada of, say two hundred years ago. Certainly in such a case there is room for wonder and admiration, but what is even that compared with the Canada of ten thousand years ago? What is that compared with the time when the spot, now occupied by Elora, first appeared above the surface of a mighty surrounding ocean, an ocean whose bottom was a mass of corals and sponges, the only vegetation being a few simple forms of sea-weed? When the

molluscan animals we now find fossilized were gifted with life and motion, and when the lily or other ennerinite with extended arms, waved gracefully to the fluctuations of the water in particular localities. Surely such considerations as these, apart from a purely scientific point of view, are sufficient to endow the study with the deepest interest, and to assist in making us what we all ought to be—happier, better, and more thoughtful men and women; enlarging our views concerning the majesty of creation, and, as a consequence, giving us a more reasonable, yet elevated conception of the Great First Cause.

Nature in every aspect affords food for the profoundest thought, and he who passes through life in total ignorance, or regardlessness of the thousand and one wonderful objects with which he is surrounded, can never be said to enjoy his existence to the full, or be considered, in point of intelligence, as but a few removes from the beasts that perish.

May our Society do at least a little towards bringing about a better state of feeling among both young and old, in Elora and its vicinity!

\*If star-fish existed in those seas, no remains of them have yet been found here, and the boy who first discovers one will be as famous in our annals as he who finds a trilobite. Fish had not appeared to populate the deep, and of the multitudes of gelatinous creatures with which the seas undoubtedly teemed, it is impossible to detect a trace.

NOTE.—Since the above was written I have learnt that the *Phacops rana* referred to was brought from Bosanquet.